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(54) Scissors and replaceable torsion blade-inserts for scissors.

(57) The scissors are provided with replaceable thin insert blades (3,4). The blade insert carriers (1,2) of the scissors are recessed to receive the blade inserts (3,4) fixed in place by a screw (5,6). The edge-to-edge force at the cutting point is controlled by the bend and the twist of the blade insert carriers (1,2). The fixation of the blade inserts (3,4) by the screw (5,6) in the front half of the blade insert carriers (1,2) and their twist in the back section, leaves the cutting edge (10,11) of the blade inserts (3,4) unsupported near the pivot point of the scissors. Torsion of the blade inserts (3,4) allows for easier control of the edge-to-edge force near the pivot without a penalty of the high edge-to-edge compliance towards the tips. Use of replaceable blade inserts (3,4) eliminates the need for resharpening of the cutting edge (10,11) and allows for use of the special purpose blade inserts (3,4) with the same basic scissors.

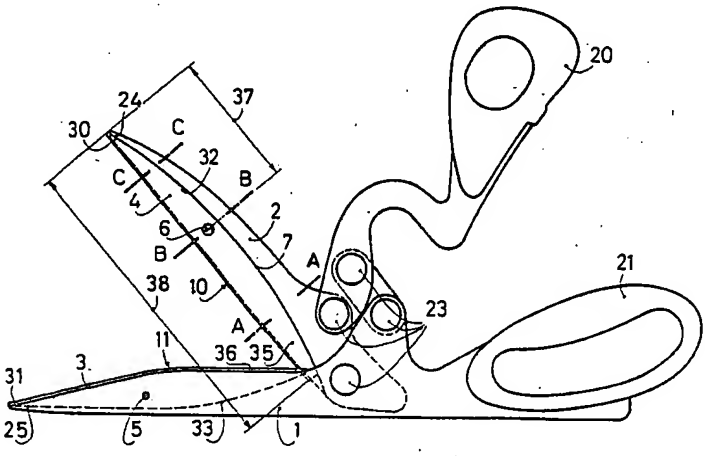

Figure 1

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This invention relates to scissors according to the preamble of claim 1. In particular it relates to scissors described in detail in the U.S. Patent No. 5,014,433, where the pivot mechanism is a four-bar linkage.

Conventional scissors require frequent resharpening, especially in demanding professional use. This calls for scissor disassembly, grinding and reassembly - a costly process, requiring special skills. With unconventional scissors such as described in the U.S. Patent No. 5,014,433, this is even more complicated, if possible at all, due to multiple joints which may even comprise rolling bearings.

Another problem of scissors is the control of the normal contact force at the edge-to-edge crossing point which moves with closing of the scissors from near the pivot point of the two cutting blades to their tips. A certain contact force is necessary for reliable cutting. This is usually achieved by bending of the blades (if made from sheet metal) or grinding (if forged or cast), in such a way that blade edges push against each other as the scissors are closed. Bending compliance of the blades increases with the third power of the distance from the pivot point. To keep the force between the blade edges approximately constant, they must be bent more towards the tip, but very little near the pivot point. In practice, edge-to-edge contact force near the pivot is controlled by the assembly of the pivot. Any loosening at the pivot will cause a poor function of the scissors at the beginning of the cut when they are near fully opened.

Different types of modular scissors with removable blades are already known; the need for them came with the use of ceramic materials for the cutting blades. These are highly priced professional tools used mostly to cut high strength fibers (carbon, kevlar, glass). However, in these known scissors the whole blade is made in ceramic and is fixed directly to the handle. The disadvantages of this design is that the whole blade has to be replaced which is costly.

The invention as claimed aims at solving both of the above described problems by providing the scissors with replaceable thin blade inserts, thus eliminating the need for re-sharpening, which are designed and fixed to the blade carriers of the scissors in such a way as to make the normal (perpendicular to the plane of blades) edge compliance near the pivot point high without increasing the compliance at the tips.

The invention solves these problems with scissors according to the characterizing part of claim 1 and with replaceable blade inserts for use in such scissors according to the characterizing part of claim 6.

The scissors according to the invention are provided with replaceable thin insert blades. The blade insert carriers of the scissors are recessed to receive the blade inserts fixed in place by a screw. The edge-to-edge force at the cutting point is controlled by the bend and the twist of the blade insert carriers. The fixation of the blade inserts by the screw in the front half of the blade insert carriers and their twist in the back section, leaves the cutting edge of the blade inserts unsupported near the pivot point of the scissors. Torsion of the blade inserts allows for easier control of the edge-to-edge force near the pivot without a penalty of the high edge-to-edge compliance towards the tips. Use of replaceable blade inserts eliminates the need for resharpening of the cutting edge and allows for use of the special purpose blade inserts with the same basic scissors.

The advantages offered by the invention are mainly:

- very little material is used to produce the blade inserts
- no need for resharpening
- possibility to use various blade insert designs and materials for different applications (blade inserts made in hard metals or ceramics can be used to cut kevlar for example with the same basic scissors used to cut silk).

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming part of this disclosure. For the better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings, examples and descriptive matter in which are illustrated and described preferred embodiments of the invention.

In the drawings:

Fig. 1 is a side view of scissors according to the invention;

Fig. 2 is a section along line A-A of Fig. 1;

Fig. 3 is a section along line B-B of Fig. 1;

Fig. 4 is a section along line C-C of Fig. 1; and

Fig. 5 is a sectioned perspective view of the front portion of the upper blade carrier of the scissors according to Fig. 1.

Figure 1 shows scissors according to U.S. Patent No. 5,014,433 having an upper handle 20, a lower handle 21, an upper blade insert carrier 2 and a lower blade insert carrier 1, all being essentially arranged in a plane 22 (Fig. 2 and 5) and interconnected by a pivot mechanism 23 consisting of a four-bar linkage.

The upper and lower blade insert carriers 1,2 are provided with essentially planar upper and lower recesses 18,19 having fixation means 26,27 for receiving and holding replaceable thin blade inserts 3,4 therein, as shown in the sections A-A, B-B and

C-C on Figures 2 - 5. The fixation means 26,27 consist of screw holes which are located at a distance 37 from the tips 24,25 of blade insert carriers 1,2. The distance 37 is inferior to the length measured between tip 25 and the pivot mechanism 23 and preferably is less than one half of that length.

The blade inserts 3,4 have the form of a thin elongated plate with a support edge 32,33, a cutting edge 10,11, a tip 30,31 and a pivot region 35,36. The blade inserts 3,4 are provided with fixation means 28,29 in the form of holes able to receive fixation means 5,6 in the form of screws by means of which the blade inserts 3,4 can be releasably fastened to the blade insert carriers 1,2. For reasons of material economy, grinding of the edges, and good function the thickness of the blade inserts 3,4 is preferably in the range of 0.5 mm to 1.5 mm.

As shown in detail in Fig. 3 the blade insert 4 is held in place by a small screw 6. Analogously blade insert 3 is fixed with screw 5 as shown in Fig. 1. The following detailed description refers only to blade insert 4, but is applicable in the same way to blade insert 3.

Support of the blade insert 4 against shear loads of cutting is provided by the edge 7 of recess 18. The blade insert carrier 2 is bent, but also twisted as can be seen from the sections A-A to C-C (Figs: 2 - 5). The twist of the blade insert carrier 2 is made only in the portion between the sections A-A and B-B resulting in the twist angle 8 at the section B-B. The twist angle 8 remains constant to the tip 24 of the blade insert carrier 2. The twist angle 8 on these sections is exaggerated in the figures - in reality the total twist angle 8 is in the range of 1° to 3°. The twist of the blade insert carrier 2 brings the cutting edge 10 of the blade insert 4 out towards each other so that the rest of the blade inserts and of the blade insert carriers clear each other at closing of the scissors. The blade insert 4 is neither bent nor twisted, but is compliant (flexible) enough to be pulled tight into the recess 18 by the fixation screw 6. This causes bending of the blade insert 4 but very little twist since the front section of the blade insert carrier 2 (where the screw 6 is placed) is not twisted. The result is an angular twist mismatch between the blade insert 4 and the blade insert carrier 2 near the pivot mechanism 23 leaving the cutting edge 10 of blade insert 4 unsupported by the blade insert carrier 2 as shown by arrow 12 on the sectioned perspective view of front section of the upper blade insert carrier 2 (Fig. 5).

The gap shown by arrow 12 decreases towards the fixation screw 6. The cutting edge 10 is supported from the fixation screw 6 to the tip 24 by the blade insert carrier 2 and therefore there is no gap in this portion of the blade.

The normal edge compliance, i.e. the ratio of the edge displacement 13 to the normal (perpendicular to the plane 22) force shown by arrow 14, applied to the edge 10 now consists of the total bending compliance of the blade insert carrier 2 and the torsional compliance of the blade insert 4 measured from the point of interest to the fixation point of screw 6. The width 15 of blade insert 4 plays an important role since the reaction force 16 at the support edge 32 of the blade insert 4 (at the recess edge 7) balances the normal force indicated by arrow 14 at the cutting edge 10 and thus generates the torsion moment 17 on the blade insert 4.

This construction gives a considerable design space for controlling the edge compliance of blade inserts 3,4 of the scissors. As the crossing point of the cutting edges 10,11 moves forward, the free twist length of the blade inserts 3,4, and thus their compliance, decreases - near the fixation point of the screws 5,6 it is completely eliminated. However, with the increase of the distance from the pivot mechanism 23 the bending compliance of the blade insert carriers 1,2 (bending stiffness of the blade inserts 3,4 is very low compared to that of the blade insert carriers 1,2) increases - the two compliances - bending of the blade insert carriers 1,2 and the torsional of the blade inserts 3,4 - combined with the bend and the twist of the blade insert carriers 1,2 give the desired edge-to-edge normal force and compliance. For reliable cutting not only the normal force at the crossing point, but also the normal compliance are important - the objective is to have a predetermined force with as low compliance as possible. The torsion of the blade insert carriers 1,2 described above makes this design objective much easier to accomplish.

Alternatively, the blade inserts could be twisted and used in conjunction with untwisted blade insert carriers while the theoretical result is be the same this possibility is considered less favourable in terms of manufacturing costs.

While the foregoing description and drawings represent the preferred embodiments of the present invention, it will be obvious for those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the present invention.

Claims

1. Scissors with upper and lower handles (20,21) and upper and lower blade insert carriers (1,2), all being essentially arranged in a plane (22) and interconnected by a pivot mechanism (23), wherein said upper and lower blade insert carriers (1,2) are provided with essentially planar

upper and lower recesses (18,19) having fixation means (5,6) for receiving and holding replaceable blade inserts (3,4) therein, whereby said fixation means (5,6) are releasable and are located at a distance (37) from the tips (24,25) of said blade insert carriers (1,2), said distance (37) being inferior to the length of said blade insert carriers (1,2) measured between said tips (24,25) and said pivot mechanism (23).

2. Scissors according to claim 1, wherein at least one of said upper or lower blade insert carriers (1,2) is twisted by a twist angle (8) with respect to said plane (22).

3. Scissors according to 2, wherein said twist angle (8) is in the range of 1° to 3°.

4. Scissors according to claim 2 or 3, wherein said twist angle (8) is the result of the blade insert carriers (1,2) being twisted between only said pivot mechanism (23) and said fixation means (5,6).

5. Scissors according to one of the claims 1 to 4, wherein said distance (37) corresponds to 40 - 60 % of said length of said blade insert carriers (1,2) measured between said tips (24,25) and said pivot mechanism (23).

6. Replaceable blade insert for use in scissors having blade insert carriers (1,2) for said blade insert (3;4), wherein said blade insert (3;4) is in the form of a thin elongated plate with a support edge (32;33), a cutting edge (10;11), a tip (24;25) and a pivot region (35;36) and wherein said blade insert (3;4) is provided with fixation means (5;6) for being releasably fastened to said blade insert carrier (1;2).

7. Insert according to claim 6 wherein said fixation means (5;6) are located at a distance (37) from the tip (24;25) of said blade insert (3;4), said distance (37) being in the range of 40 - 60% of the length of said blade insert carrier (1;2) measured between said tips (24,25) and said pivot mechanism (23).

8. Insert according to claim 6 or 7, wherein said blade insert (3;4) is twisted in the pivot region (35;36) by an angle.

9. Insert according to claim 8, wherein said angle is in the range of 1° to 3°.

10. Insert according to one of the claims 6 to 9; wherein the thickness of said blade insert (3;4) is in the range of 0.5 mm to 1.5 mm.

11. Scissors with upper and lower handles (20,21) and upper and lower blade insert carriers (1,2), all being essentially arranged in a plane (22) and interconnected by a pivot mechanism (23), wherein said upper and lower blade insert carriers (1,2) are provided with essentially planar upper and lower recesses (18,19), wherein replaceable blade inserts (3,4) are held by means of fixation means (5,6) which are releasable and are located at a distance (37) from the tips (24,25) of said blade insert carriers (1,2), said distance (37) being inferior to the length of said blade insert carriers (1,2) measured between said tips (24,25) and said pivot mechanism (23).

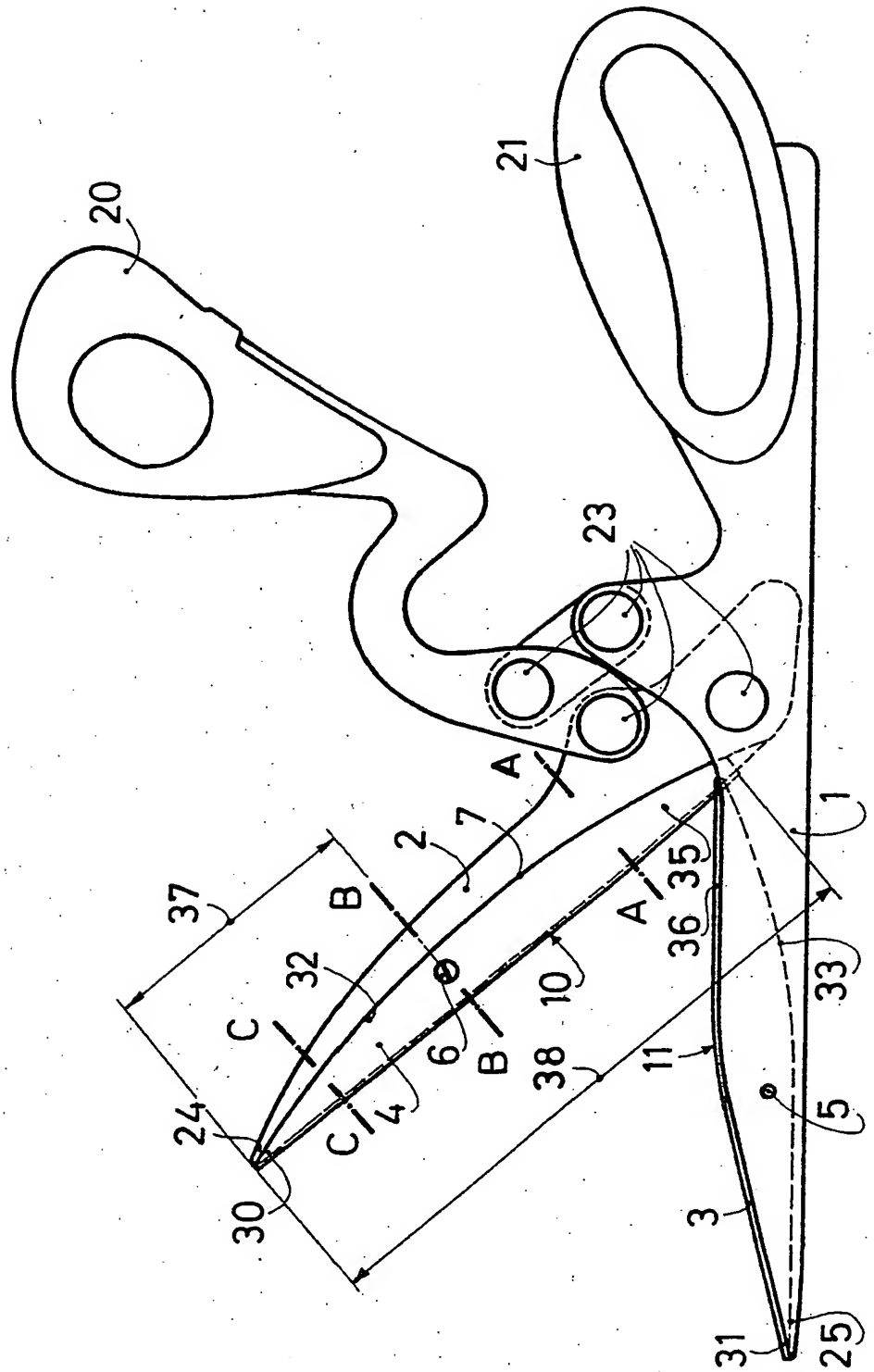

Figure 1

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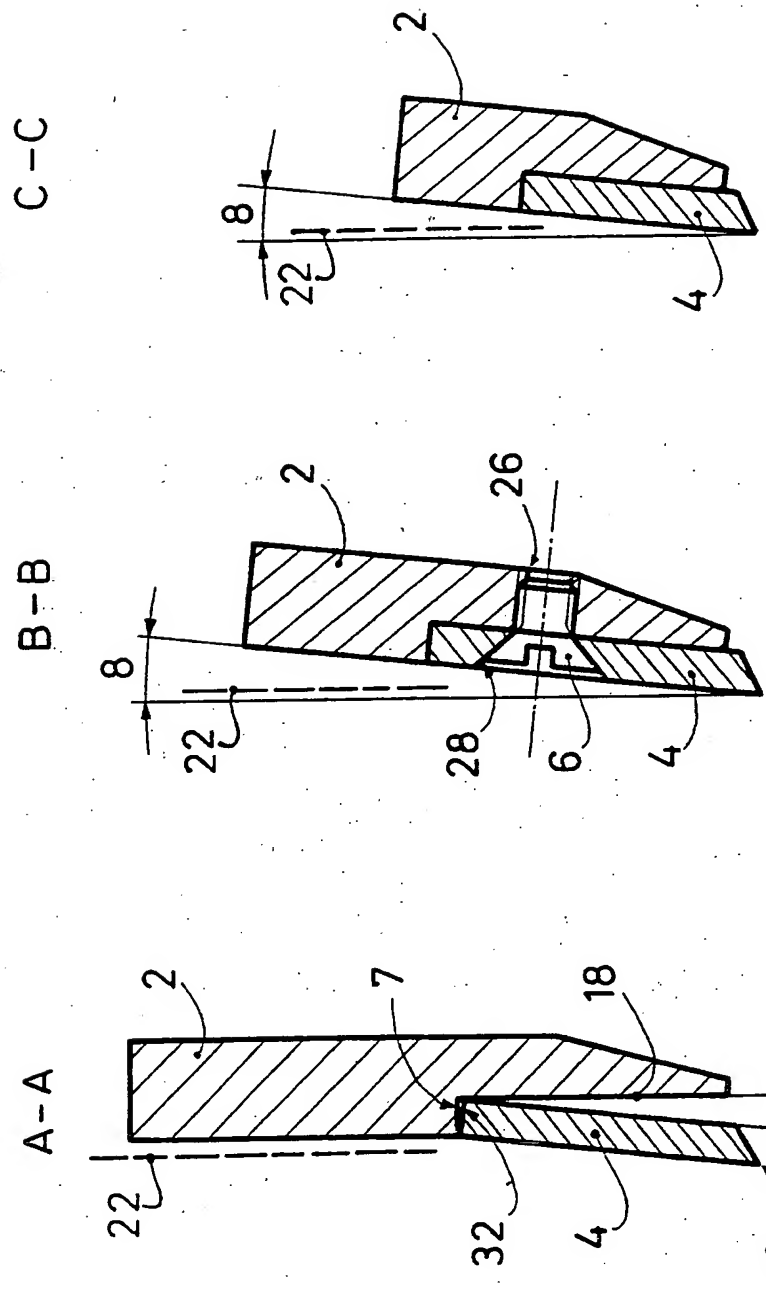

Figure 2

Figure 3

Figure 4

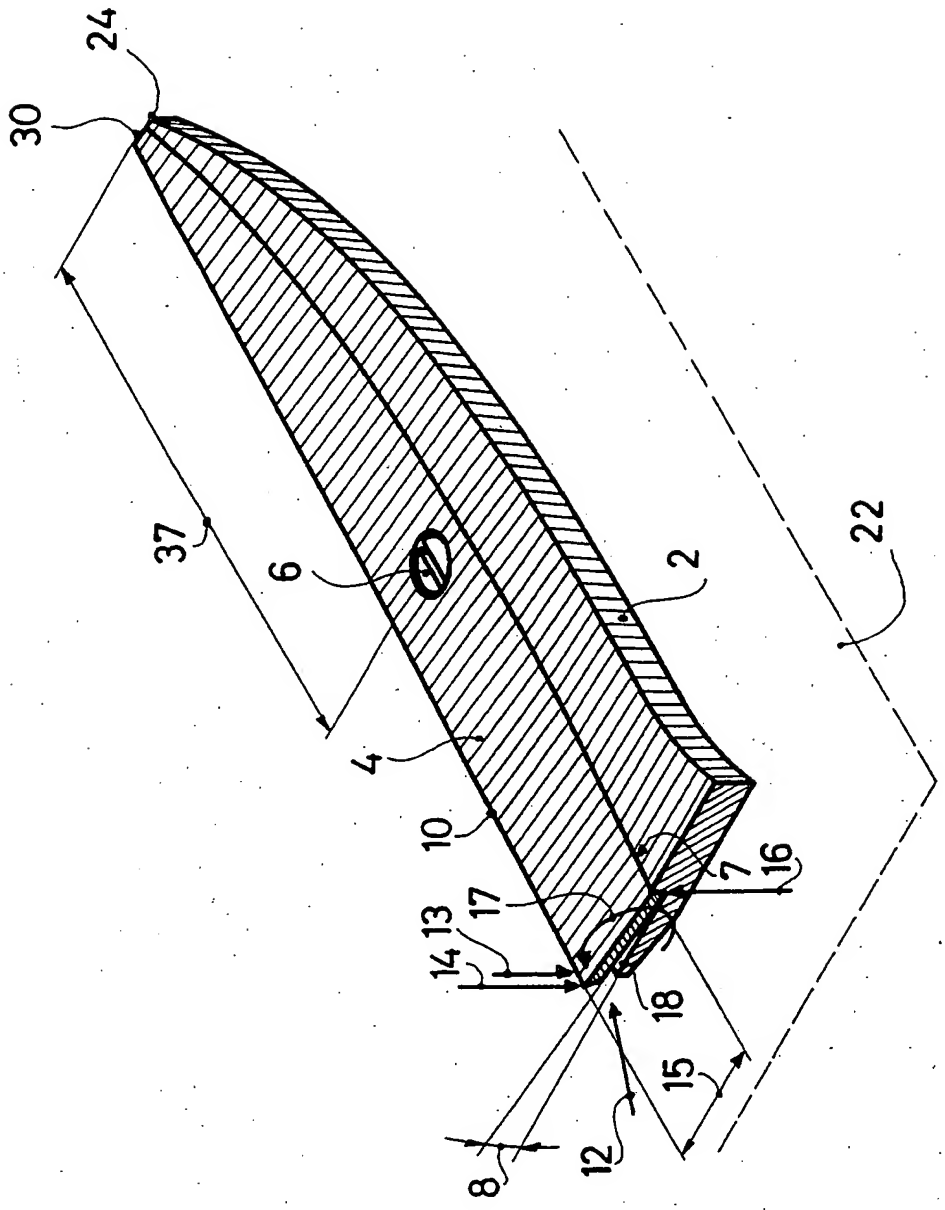

Figure 5

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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 1509

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X A	US-A-2 284 664 (K. KISSLING) * figures 1,4,4A,14 * * page 1, right column, line 50 - page 3, left column, line 67 *	1,6,8,11 7	B26B13/04
X A	DE-A-22 01 248 (SPENGLER & MEURER) * the whole document *	1,2,11 3-5	
X A	US-A-1 628 856 (I. PATRICK) * page 1, line 39 - page 2, line 61; figures *	1,5-7,11 10	
A	FR-A-961 388 (B. POLAK) * page 2, line 96 - page 3, line 7; figures 1-3 *	1,6,11	
A	GB-A-923 287 (RICHARDS BROS. & SONS LTD.) * page 2, line 39 - page 3, line 21; figures *	1,6,11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5) B26B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 November 1993	RAVEN, P

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